



CHILD BEHAVIOUR MANAGEMENT: PHARMACOLOGICAL STRATEGIES (INHALATION SEDATION)

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INTRODUCTION

While non-pharmacological behaviour management strategies may be sufficient for the majority of child dental patients, there still remains a proportion for whom further adjunctive therapies are required to allow for safe and efficient dental interventions. For some children, the decision might be taken that general anaesthesia is the best course of action, whilst for others conscious sedation might be more appropriate. The second half of this series provides a brief overview of the recommendations for the use of inhalation sedation for healthy anxious children in the UK. Readers are directed to national^{1,2} and international^{3,4} guidance for further detail relating to training, staffing, equipment and facilities expected within the UK.

CONSCIOUS SEDATION

The Intercollegiate Advisory Committee for Sedation in Dentistry (IACSD)² and Scottish Dental Clinical Effectiveness Programme (SDCEP)³ produce guidance with respect to the provision of conscious sedation in dentistry, with clinical recommendations for its use in children produced by NICE⁴ and overarching guidance from the Academy of Medical Royal Colleges.⁵ The following definition of conscious sedation is widely accepted within the UK:

“A technique in which the use of a drug or drugs produces a state of depression of the central nervous system enabling treatment to be carried out, but during which verbal contact with the patient is maintained throughout the period of sedation. The drugs and techniques used to provide conscious sedation for dental treatment should carry a margin of safety wide enough to render loss of consciousness unlikely.”^{2,3}

There are a variety of drugs (inhalational agents, benzodiazepines, hypnotics and psychosedatives) and sedation techniques (oral, intravenous, intranasal, inhalation) which can be used to achieve this level of sedation. These are categorised into ‘basic’ and ‘advanced’ techniques, dependent on age (Table 1).^{2,3} Universal guidance dictates a minimally invasive approach; that in every situation the chosen technique should be the safest option which best fits the interests of the child³, bearing in mind the key aims of conscious sedation⁵:

- To provide sedation and relieve anxiety
- To maintain consciousness and patient cooperation
- To maintain control of physiological parameters

There is clearly no place in the UK for ‘deep sedation’, and those employing ‘advanced’ techniques should ensure adherence to guidance on appropriate qualifications, training and experience for the safe management of any adverse events.²

Table 1: IACSD/SDCEP Guidance ^{2,3}		
	'Basic' Techniques	'Advanced' Techniques
Child <12 years	Inhalation sedation with nitrous oxide/oxygen	Midazolam by any route
Young Person 12 – 16 years	<ul style="list-style-type: none"> Inhalation sedation with nitrous oxide/oxygen Midazolam by any route (intravenous, oral or transmucosal) 	<ul style="list-style-type: none"> Certain drugs used for sedation (e.g. ketamine, propofol, sevoflurane) Combinations of drugs used for sedation (e.g. opioid plus midazolam, midazolam plus propofol, sevoflurane plus nitrous oxide/oxygen) Combined routes of administration (e.g. oral plus intravenous)
Adult 16 years or over	<ul style="list-style-type: none"> Inhalation sedation with nitrous oxide/oxygen Midazolam by any route (intravenous, oral or transmucosal) 	

CHOICE OF SEDATION

A holistic approach is needed when selecting the most suitable sedation option for any given treatment plan. This should be undertaken by clinicians with relevant experience and training, taking into consideration the following factors^{3,4,5}:

- The healthcare needs of the patient (dental history/medical history/ASA status)
- The psychological needs of the patient (emotional development/dental anxiety)
- The target level of sedation required
- Indications/contraindications of drug and route
- Pros/cons of drug and route
- Patient/parent/carer preference
- Expertise/skill of the clinician

Inhalation sedation (IHS) with nitrous oxide and oxygen is typically the preferred technique for children with mild-to-moderate anxiety

Table 2: IHS with Nitrous Oxide and Oxygen ^{1,6,7}	
Indications	Contraindications
Management of: <ul style="list-style-type: none"> • Dental anxiety • Needle phobia • Gag reflex • Medically compromised e.g. cardiac ischaemia and asthma 	<ul style="list-style-type: none"> • Upper respiratory tract infections • Severe respiratory disease • Nasal obstruction • Mouth breathers • Very young/pre-cooperative children • Caution advised e.g. recent eye surgery, anti-folate based immunosuppressants

owing to its pharmacological properties.¹ Nitrous oxide has been used for conscious sedation in dentistry since the 1960s.⁶ It is a colourless, faintly sweet-smelling insoluble gas, which is transported as a free gas in the blood, but interestingly its mode of action is still unknown.^{6,7} It carries a very wide margin of safety, with rapid onset and recovery, and is almost entirely eliminated unchanged by the lungs. Further indications, contraindications, pros and cons of IHS with nitrous oxide and oxygen are shown in Tables 2 and 3.

Regardless of the choice of sedative technique, all such adjunctive therapy must be used as exactly that, an 'adjunct', and not a substitute. Good communication and use of non-pharmacological behaviour strategies should still be employed. Without these the effect of IHS is dramatically reduced. Tailored oral health promotion and prevention should also be included for all patients, and efforts should be made to support the transition to acceptance of treatment without sedation in the long term.

GUIDANCE AND RECOMMENDATIONS – inhalation sedation

Training and CPD

Introduced in 2015, the IACSD guidance makes clear the expected level of available expertise and skillset of any team providing conscious sedation in dentistry.² Their new guidance in 2020 has not changed on this. They outline the training expected of the dental team, and oversee educational bodies with respect to curriculum/syllabus content and validation/accreditation of courses.²

Regardless of the techniques used, training must include^{2,3}:

- Annual immediate life support/paediatric immediate life support
- A second suitably trained person is needed. Dental nurses require training, such as that provided by the National Examining Board for Dental Nurses (NEBDN)

Practice protocols should clearly outline the roles, responsibilities and accountability of each member of the dental team, including patient preparation, sedation, recovery and discharge, as well as management of adverse events.³

Participation in CPD is a statutory GDC requirement for all dental professionals.^{2,3} IACSD recommend a minimum of 12 hours of relevant CPD every 5 years² whilst additional service requirements, such as self-declaration of competence, are outlined in NHS commissioning guidance.⁸

Table 3: IHS with Nitrous Oxide and Oxygen ^{1,6,7}	
Pros	Cons
<ul style="list-style-type: none"> • Anxiolysis • Analgesia • Reduced gagging • Minimal metabolism • Wide margin of safety • Easy non-threatening administration (no needles) • Operator-sedation technique • Adjustable dose and duration • Rapid onset and recovery 	<ul style="list-style-type: none"> • Mild sedative • No amnesia • Greenhouse gas/pollution <p>With chronic/excessive use (>100ppm/8hr): Haematological (B12/ pernicious anaemia), infertility/miscarriage</p>

Equipment and facilities

IACSD and SDCEP outline recommendations for the clinical environment and equipment expected of dental sedation practices.^{2,3} This includes access for emergency services and transfer of patients (if necessary) for the management of adverse events.² A quality assurance process, including periodic inspection should also be in operation. Detailed guidance and support is available through the Safe Sedation Practice Scheme offered by the Society for the Advancement of Anaesthesia in Dentistry (SAAD) (<https://www.SAAD.org.uk/documents>).

For IHS, specific equipment recommendations include³:

- Appropriate risk assessments and records maintenance
- Maintenance and servicing of purpose-built inhalation sedation machinery according to manufacturers' instructions
- Appropriate storage of gas cylinders
- Compliance with COSHH standards with respect to room ventilation and active scavenging

Consent and patient/parent preparation

Obtaining valid informed consent from the parent/carer and the patient (wherever possible) is a GDC requirement, and is in keeping with UK ethical and legal guidance.⁷⁻⁹ It should include age-appropriate written and verbal information relating to^{2,3,4}:

- The proposed sedation technique, alternative options, risks and benefits
- The roles/expectations of the child, their escort and the practitioner (children <16 years require an escort for inhalation sedation²)
- The anticipated sensations and sounds
- How to cope with the procedure
- Fasting is not required for IHS

Undertaking the consent process prior to the treatment appointment facilitates good communication and establishes trust, ensuring the management of expectations and a full appreciation the child's wishes and needs.³ Occasionally very anxious children may benefit from taking home a nasal hood to familiarise themselves and practice their breathing.

Pre-assessment and safety checks

It is highly recommended that a proforma/checklist be used to standardise practices and avoid error when undertaking pre-assessment and equipment safety checks.⁵

- **Equipment factors:** A standard safety checklist of the IHS equipment should be undertaken before use, and a record kept.
- **Patient factors:** Prior to commencing treatment, a review of the patient's presenting complaint and medical history is necessary, alongside confirmation of consent and justification for sedation.^{2,3}
- **Staffing factors:** An appropriately trained second person should be present throughout treatment, and the sedationist should be chaperoned at all times.^{1,2} Another member of staff (third person) should be available to manage other aspects of the practice e.g. a receptionist.

Carrying out treatment

- **Gain adequate sedation:** Standard practice is to titrate the concentration to patient response. Starting with 100% oxygen and an appropriate flow rate, incremental changes of N₂O (10% per minute up to 80% and 5% per minute thereafter) until the desired level of sedation is reached.⁶ Typically,

dissociation sedation is reached at N₂O concentrations between 20-55%.⁶ Signs and symptoms of sedation are outlined in Table 4, but each patient experience is individual. Use of psychopharmacological assistance (calm relaxing voice, reassurance and storytelling) are extremely beneficial and facilitate the effects of IHS.

- **Clinical monitoring:** For IHS this involves checking the level of consciousness, airway patency, respiration (rate, rhythm, depth) and skin colour. Additional monitoring may be required for medically compromised patients, e.g. pulse oximetry.^{2,5}
- **Note-keeping:** Thorough note-keeping is essential, and should include^{2,5}:
 - Name and signature of the operator and assistant(s)
 - Clear treatment plan
 - Medical history
 - Radiographs
 - Justification for sedation
 - Operative treatment that was performed
 - Sedation: drug name, concentration, dosage, duration and quality of sedation achieved.
- **Recovery and discharge:** Following completion of treatment, administer 100% oxygen for 2-5 minutes. Recovery should be supervised to ensure the child is oriented in time, place and person, and is walking unaided. The child should be discharged into the care of their escort, with relevant written and verbal post-operative instructions relating to the procedure, local anaesthesia and post-operative sedation period.^{2,3}

Audit and QA

IACSD and SDCEP consider audit a core requirement of quality assurance.^{2,3} Clinicians should maintain a log of all cases and details e.g. patient type, drug used, route, dose, sedation score, adverse events. SAAD produce a useful training log (<https://www.SAAD.org.uk/documents>). Records of staff training, reflection and CPD could also support this.

CONCLUSION

As dental professionals we require a significant level of trust and compliance from our child patients, in the face of what can be demanding, time consuming and intimidating procedures. The ability to offer adjunctive pharmacological assistance, such as inhalation sedation, is an invaluable skill, facilitating the very best possible experience. As with all clinical interventions, the appropriate level of training, staffing, equipment and facilities (in line with current guidance) is essential, underpinned by a robust quality assurance process.

Table 4: Signs and symptoms of sedation^{6,7}

Signs	Symptoms
<ul style="list-style-type: none">• Peripheral vasodilation (flushing of extremities and face)• ▼ muscle tone as anxiety reduces (arms and legs relax)• Normal, smooth respirations	<ul style="list-style-type: none">• Light headedness/dizziness• Wave of warmth• Tingling of hands and feet• Analgesia - numbness of oral soft tissues, hands and feet• Euphoric feeling• Feeling of lightness of extremities



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